Abstract of the Disclosure

An orthogonal wavelet division multiplexing (OWDM) communication system including a synthesis section and a channel interface. The synthesis section includes a filter pair bank with multiple inputs and an output that provides an OWDM signal. Each input receives a corresponding symbol of a supersymbol, where the symbols are from a selected modulation scheme. The synthesis section generates the OWDM signal as a combination of weighted OWDM pulses, where each weighted OWDM pulse represents of a symbol of the supersymbol. An OWDM Spread Spectrum (OWSS) communication system that uses broad-time and broadband pulses generated from a family of OWDM pulses together with a set of orthogonal PN code vectors. The OWSS pulses are mutually orthogonal and allow multi-user operation. Each user is assigned an OWSS pulse corresponding to a particular PN code. OWSS enables high rate operation for wireless channels with the use of an equalizer with FE and DFE sections.